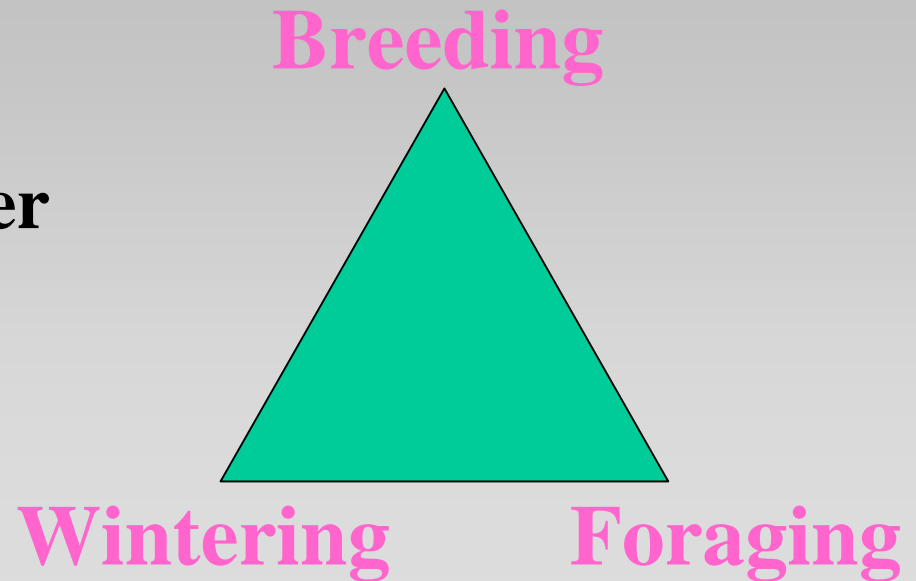


A Watershed Based Approach to Assessing Amphibian Status

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Complex Life Histories

- * Complex Habitat Use
- * Managers Need to Consider Full Triangle of Habitats and Migration Corridors
- * Year round residents



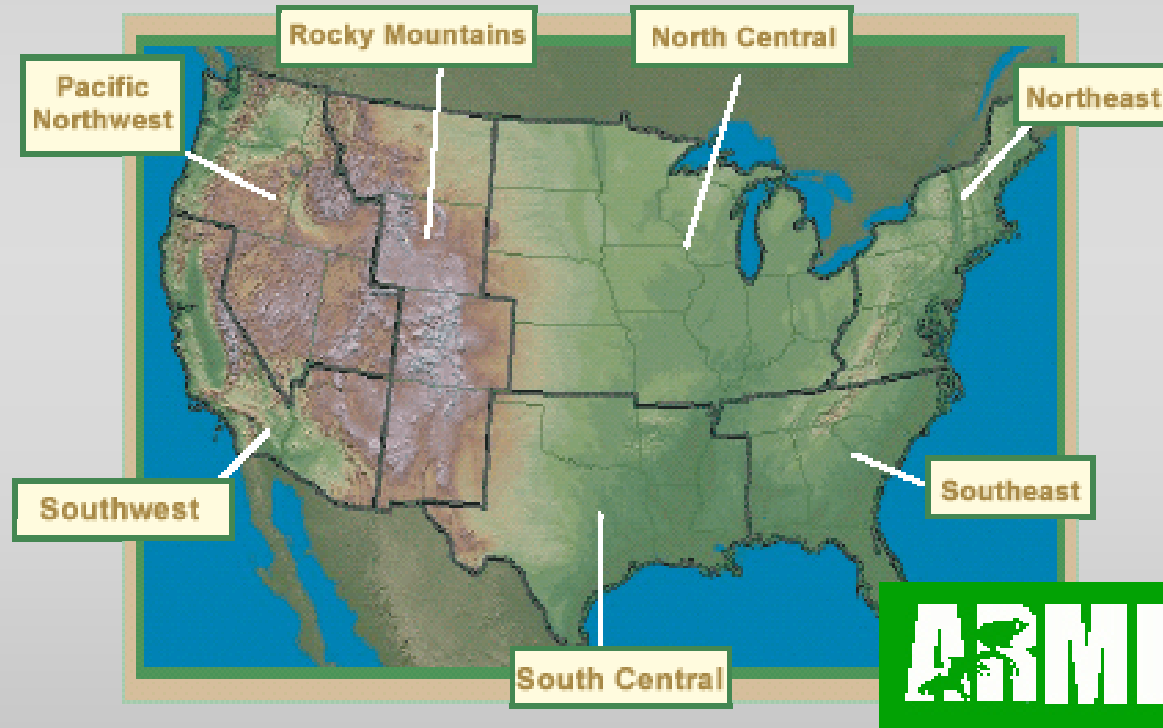
**Ectothermy/Abundance and
Importance to Food Web**

Amphibian Declines and Malformations

Amphibians as Vehicles for Wetland Assessment

USGS Amphibian Research and Monitoring Initiative

- Monitor status and trends
- Study amphibian malformations
- Develop partnerships to expand the scope of monitoring and research

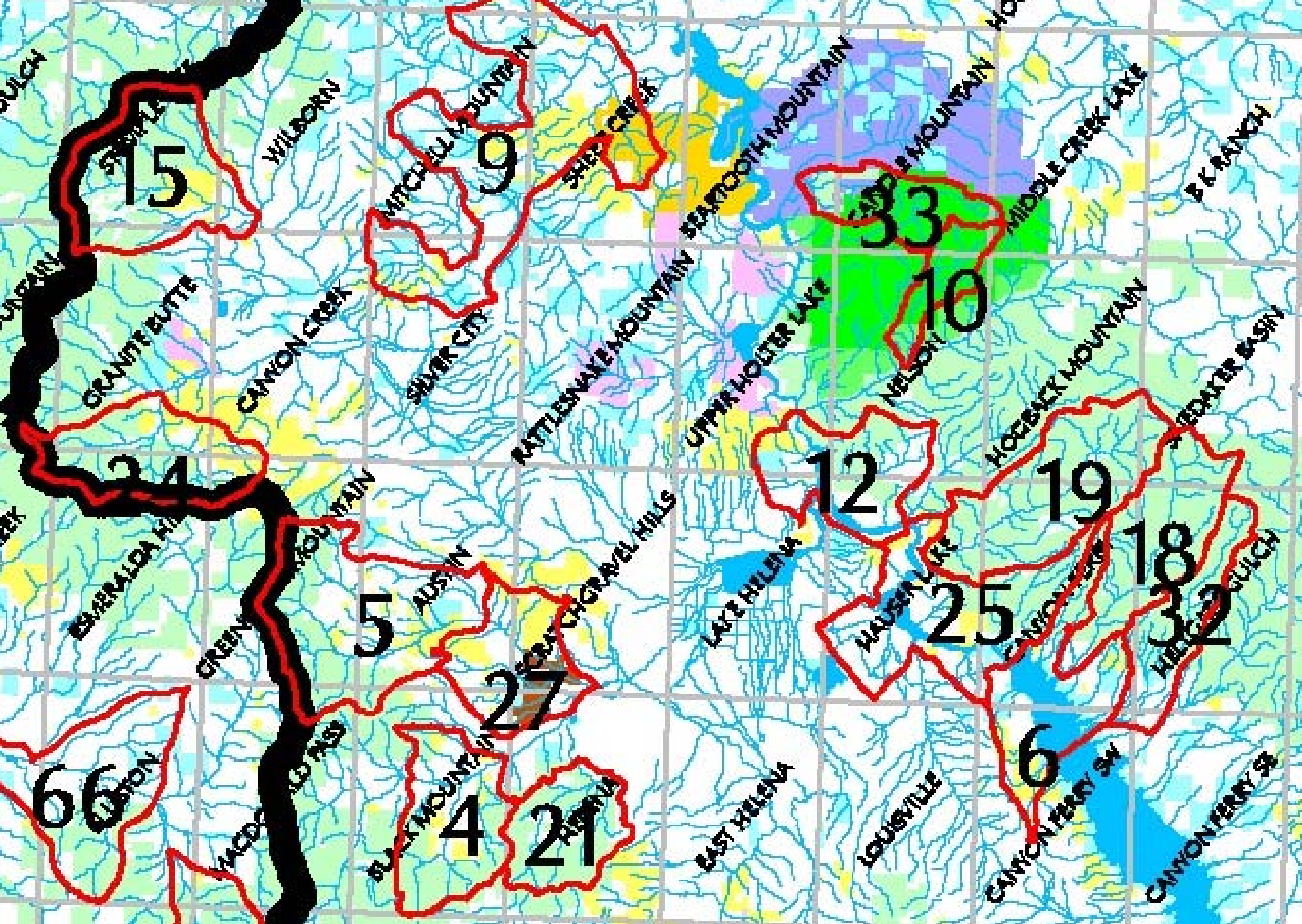


Other Partners: USFS, BLM, NPS, State Wildlife Grants, and Tribes

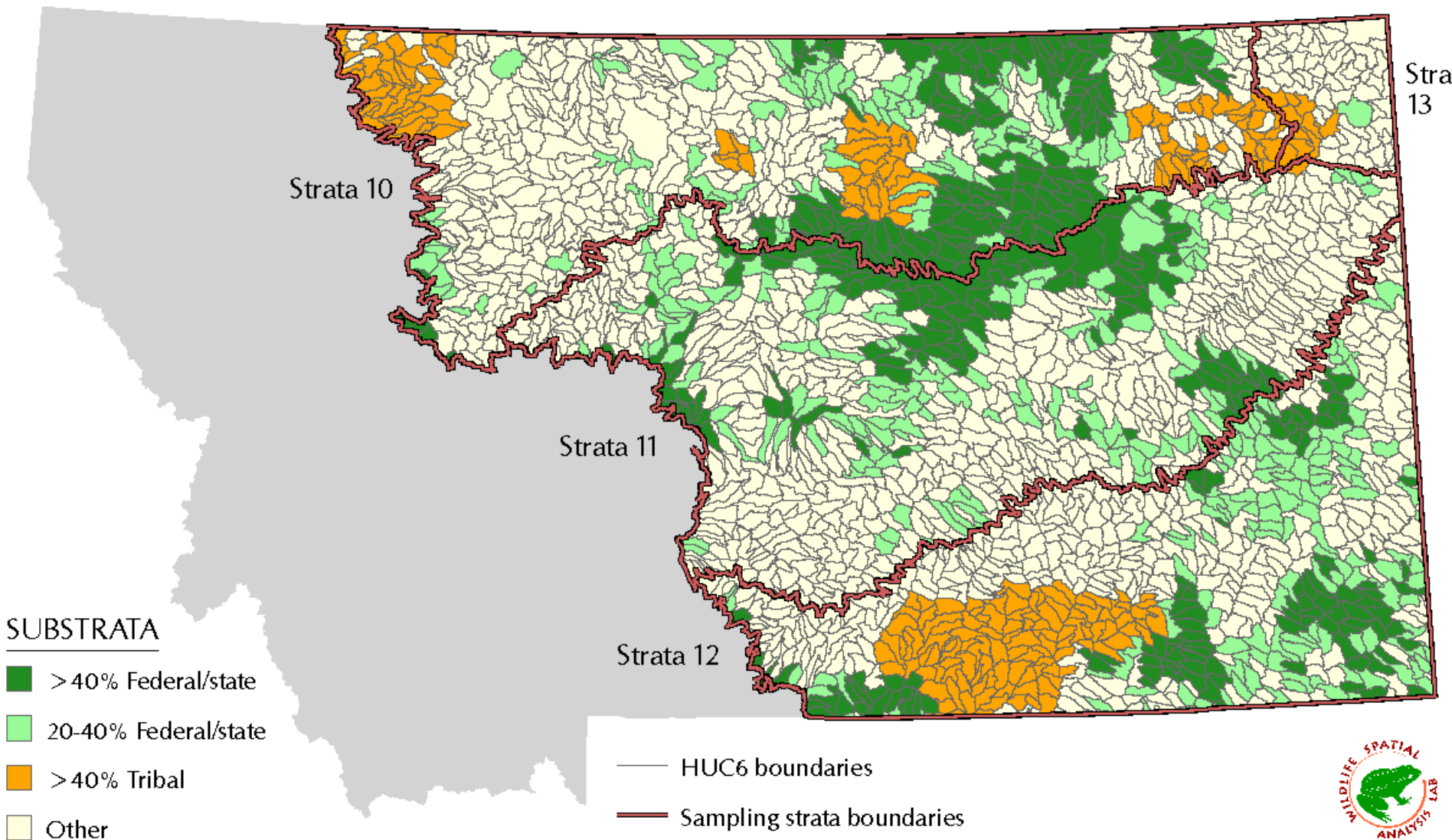
Montana Declines - Northern Leopard Frog (*Rana pipiens*)



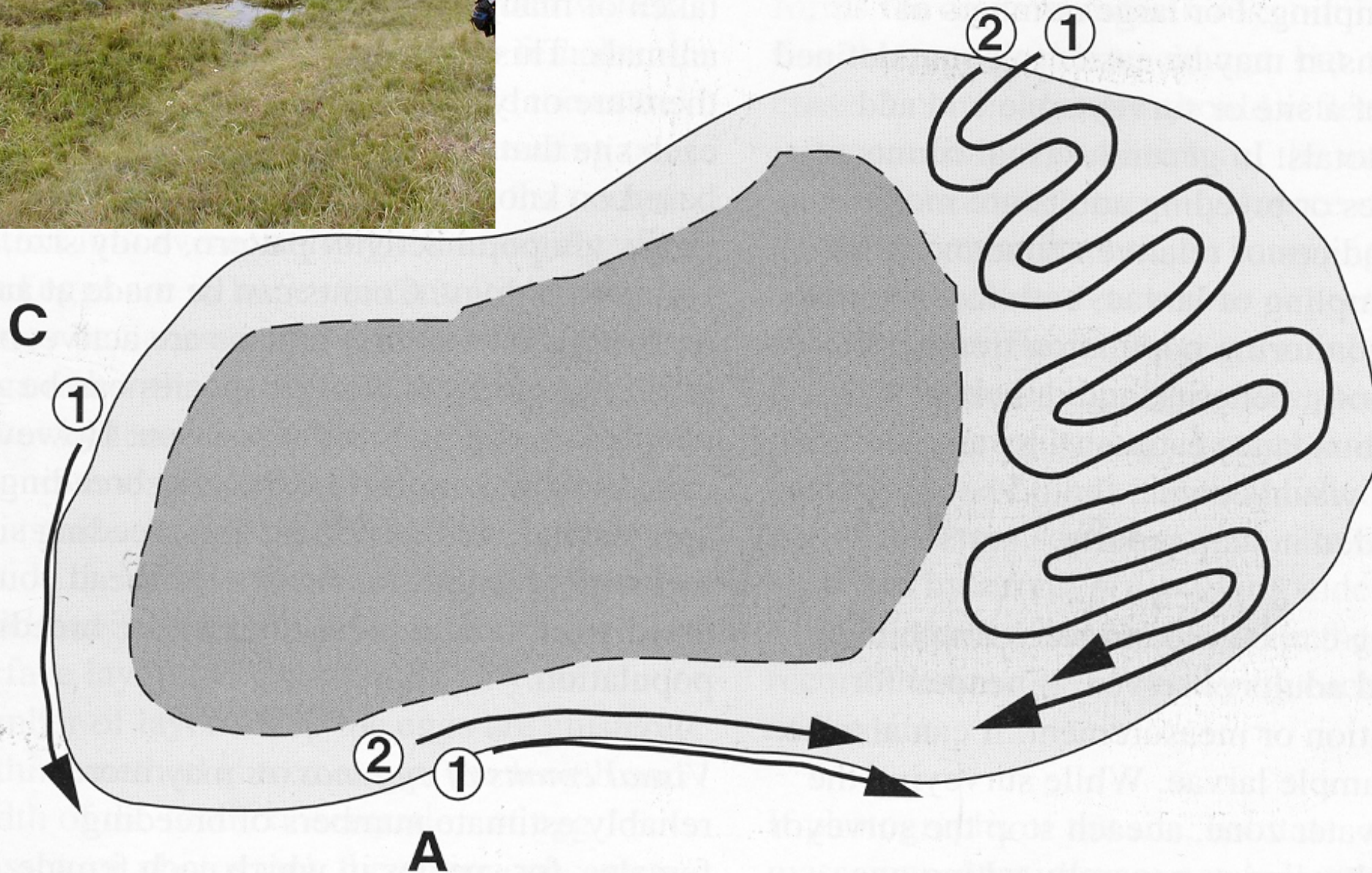
Pre and Post-1990 Distributions



Draft Strata for Amphibian Sampling



Timed Visual Encounter (VES) and Dipnet Surveys of Shallow water Habitats



Some Inventory Highlights 2000-2004

- **Surveys of 300+ watersheds and >5,500+ sites**
- **5,000+ new species records**
- **Established new state high elevation records for 8 species**
 - Long-toed Salamander
 - Rocky Mountain Tailed Frog
 - Boreal Chorus Frog
 - Pacific Treefrog
 - Columbia Spotted Frog
 - Northern Alligator Lizard
 - Rubber Boa
 - Common Gartersnake
- **Extended known geographic ranges for 8 species**
 - Long-toed Salamander
 - Tiger Salamander
 - Coeur d'Alene Salamander
 - Western Toad
 - Boreal Chorus Frog
 - Pacific Treefrog
 - Rubber Boa
 - Western Rattlesnake

Carpp Creek - (HUC ID = 4_028 & ICBEMP HUC ID =170102021002)

Map Legend

Black Cross = Potential lentic sites surveyed, but providing no breeding or overwintering habitat and not worth future survey due to reasons indicated in notes.

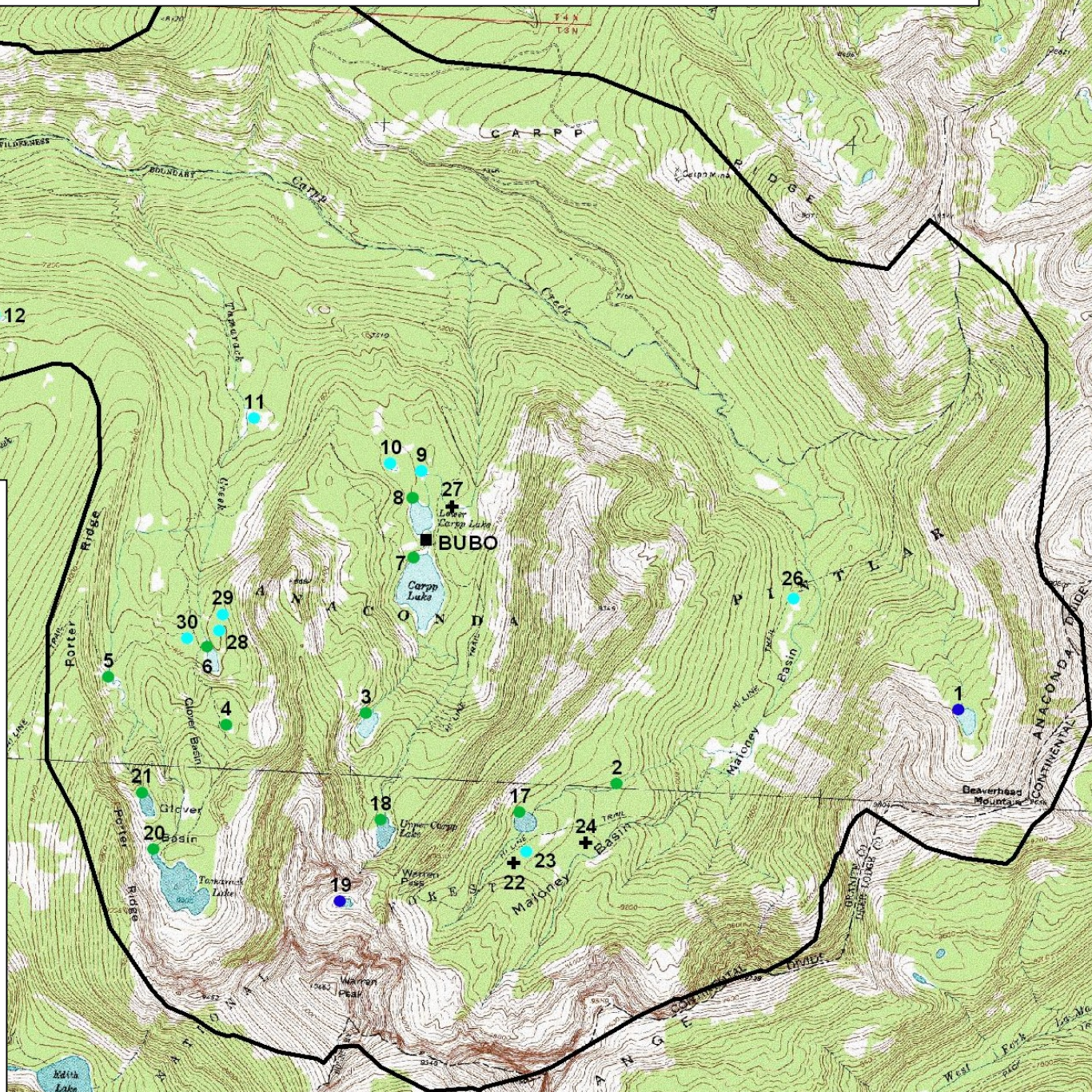
Black Square = Incidental observation of species indicated.

Brown Circle = Ephemeral lentic site that may support larval development in a wetter year, but was dry at the time of the survey.

Light Blue Circle = Ephemeral, or possibly a shallow permanent, lentic site that is likely to support larval development, but is unlikely to support aquatic overwintering.

Green Circle = Permanent lentic site with emergent vegetation that could support larval development and aquatic overwintering.

Dark Blue Circle = Permanent lentic site without emergent vegetation that could support larval development and aquatic overwintering.




Carpp Creek - (HUC ID = 4_028 & ICBEMP HUC ID =170102021002)

2003 Water Body and Survey Summary

Number of Potential Lentic Sites Surveyed	27		Number of Fishless Potential Lentic Overwintering Sites	9
Number of Wet Lentic Sites	23		Potential Lentic Overwintering Sites	001, 002, 003, 004, 005, 006, 007, 008, 009, 017, 018, 019, 020, 021
Number of Dry Lentic Sites	1		Permanent Lentic Sites with Emergent Vegetation	002, 003, 004, 005, 006, 007, 008, 017, 018, 020, 021
Number of Potential Lentic Overwintering Sites	14		Permanent Lentic Sites without Emergent Vegetation	001, 019

2003 Species Detection Summary

Species	Lentic Sites Where Detected (Underlined = breeding)	Number and % of Wet Lentic Sites Where Detected	Number and % of Wet Lentic Sites with Breeding Detected	Comments
Long-toed Salamander (AMMA)	<u>003</u> , <u>009</u> , <u>010</u> , <u>012</u> , <u>015</u>	5 (22%)	5 (22%)	-
Western Toad (BUBO)	<u>007</u> , 008	2 (9%)	1 (4%)	-
Columbia Spotted Frog (RALU)	<u>002</u> , <u>003</u> , 006, 007, <u>008</u> , <u>009</u> , <u>010</u> , <u>012</u> , <u>018</u> , 028, <u>029</u> , <u>030</u>	12 (52%)	9 (39%)	-
Common Gartersnake (THSI)	012, 015	2 (9%)	-	-
Fish Detected	005 (unidentified trout species), 007 (did not detect fish, but found lots of evidence of fishing), 008 (unidentified trout species), 020 (unidentified trout species), 021 (Rainbow Trout) ⁷	5 (36%) ⁴	-	-

Information on Apparent Occupancy and Breeding Rates for Regional Status				
Species	Number and Percent of Watersheds That Were Occupied ³ (N = 21)	Number and Percent of Watersheds Where Breeding Was Detected ³ (N = 19)	Number and Percent of Sites Containing Water That Were Occupied ⁴ (N = 205)	Number and Percent of Sites Containing Water Where Breeding Was Detected ⁴ (N = 205)
Long-Toed Salamander (<i>Ambystoma macrodactylum</i>)	15 71% (95% CI = 55% - 88%)	15 79% (95% CI = 63% - 95%)	59 29% (95% CI = 23% - 35%)	59 29% (95% CI = 23% - 35%)
Rocky Mountain Tailed Frog ⁵ (<i>Ascaphus montanus</i>)	5 24% (95% CI = 8% - 40%)	4 21% (95% CI = 5% - 37%)	10 4.9% (95% CI = 1.9% - 7.8%)	6 3% (95% CI = 0.6% - 5.2%)
Western Toad (<i>Bufo boreas</i>)	8 38% (95% CI = 20% - 56%)	2 10.5% (95% CI = 0% - 23%)	8 3.9% (95% CI = 1.3% - 6.6%)	3 1.5% <u>(95% CI = 0% - 3.1%)</u>
Pacific Treefrog ⁶ (<i>Pseudacris regilla</i>)	2 9.5% (95% CI = 0% - 20%)	2 10.5% (95% CI = 0% - 23%)	2 1% (95% CI = 0% - 2.3%)	2 1% (95% CI = 0% - 2.3%)
Columbia Spotted Frog (<i>Rana luteiventris</i>)	18 86% (95% CI = 73% - 99%)	15 79% (95% CI = 63% - 95%)	96 47% (95% CI = 40% - 54%)	52 25% (95% CI = 19% - 31%)
Terrestrial Gartersnake ⁷ (<i>Thamnophis elegans</i>)	11 52% (95% CI = 34% - 71%)	NA	27 13% (95% CI = 9% - 18%)	NA
Common Gartersnake ⁷ (<i>Thamnophis sirtalis</i>)	7 33% (95% CI = 16% - 51%)	NA	33 16% (95% CI =11% - 21%)	
Non-indigenous ⁷ Salmonid Fishes	13 68% (95% CI = 51% - 86%)	NA	39 19% (95% CI = 14% - 24%)	

Evaluating Detection Probabilities for True Site Occupancy Rates

- Software PRESENCE or MARK
- Examines detection histories analogous to mark-recapture models

Detection History Example

<u>Detection History</u>	<u>Probability Statement</u>
1001	$\text{psi} \times (p[1])(1-p[2])(1-p[3])(p[4])$
0001	$\text{psi} \times (1-p[1])(1-p[2])(1-p[3])(p[4])$
0000	$\text{psi} \times (1-p[1])(1-p[2])(1-p[3])(1-p[4]) + (1-\text{psi})$

Evaluate Candidate set of Models with Data using AIC

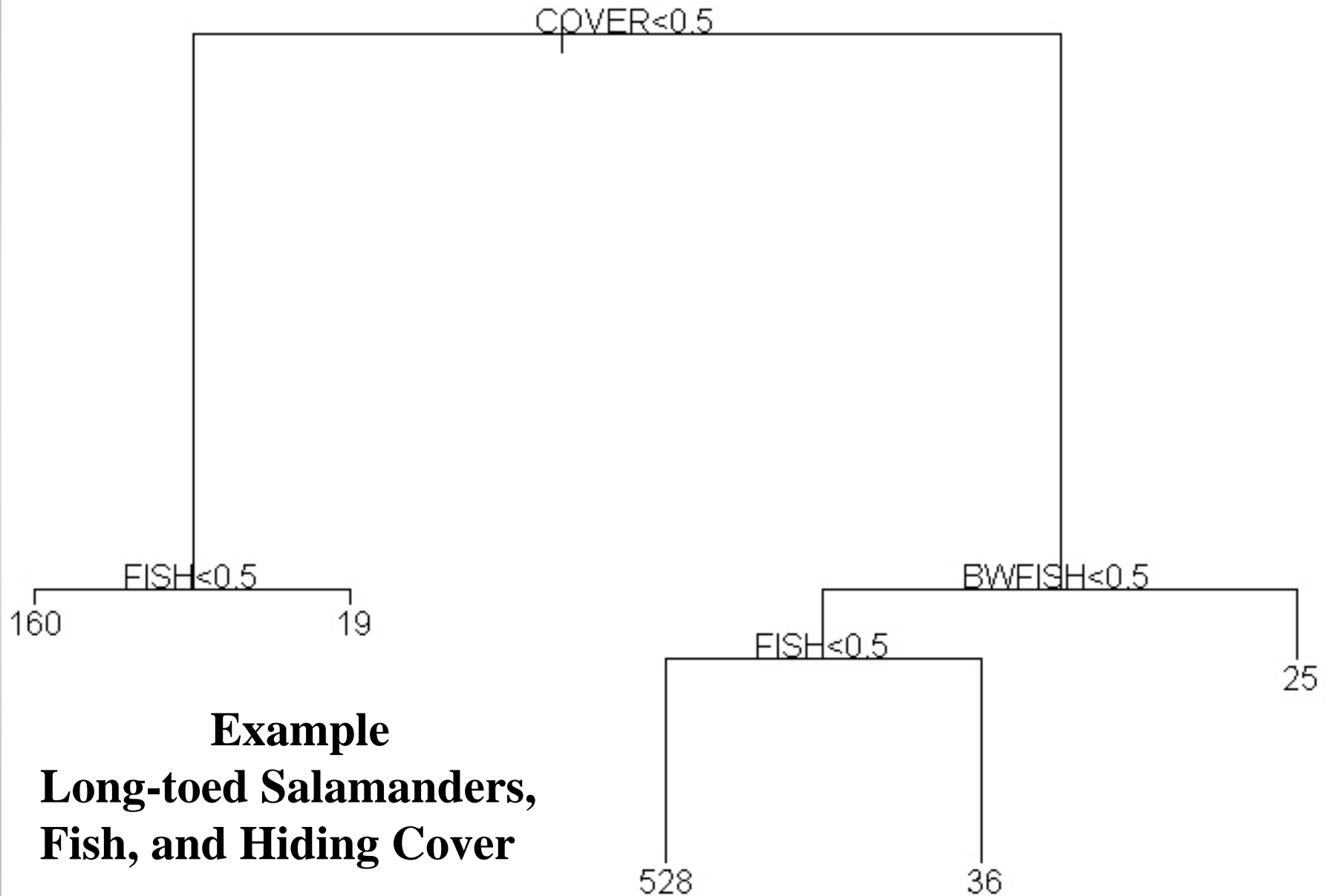
$\text{Psi}(\cdot)p(\cdot)$	Occupancy and detection probability constant across sites
$\text{Psi}(\cdot)p(\text{VegArea})$	Occupancy constant, but detection dependent of VegArea
$\text{Psi}(\text{FuncType})p(\text{weather})$	Occupancy dependent on wetland type detection dependent on weather

Lessons on Variability Between Observers

- Variability can be very high
- Photographic training set
- Photo cards in field for constant reference
- Need continuous feedback and recalibration during mid season

*Use PDAs

Modeling Landscape and Local Determinants of Site Occupancy Using Classification and Regression Trees (CART)



Archived Photos and Datasheets

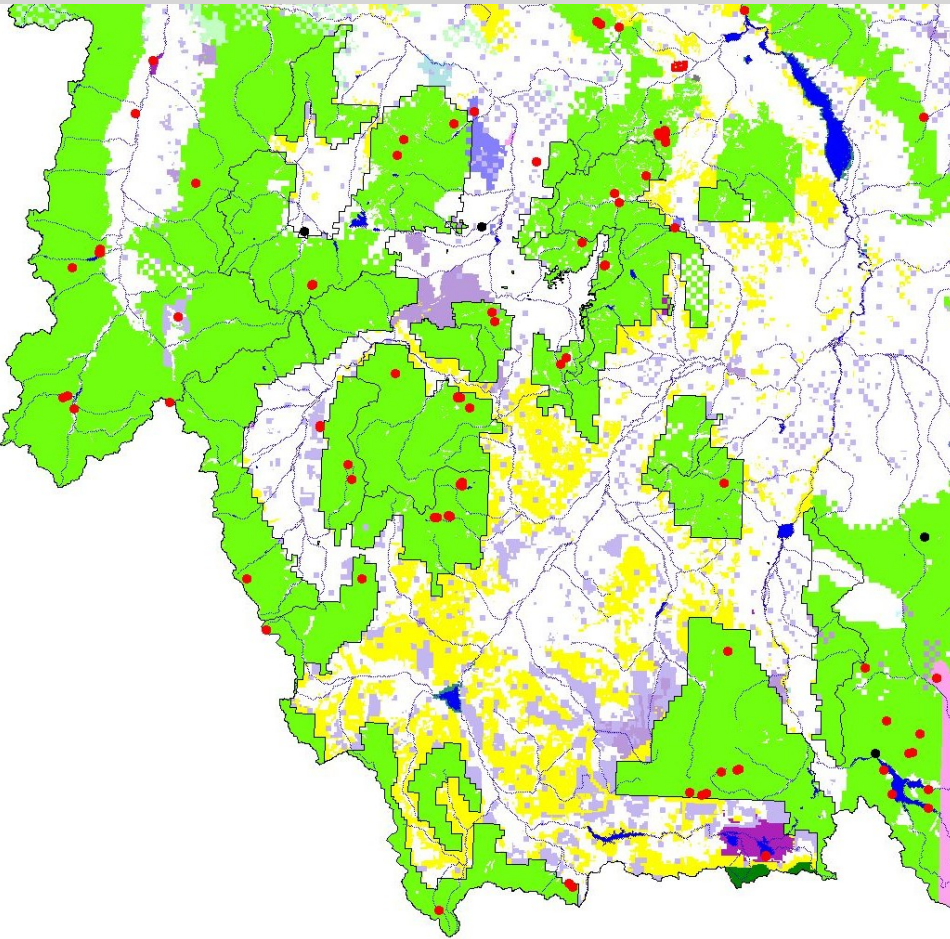


Status of Western Toad (*Bufo boreas*)

Breeding Records

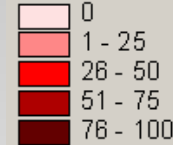
Pre-1990 - Black

Post-1990 - Red

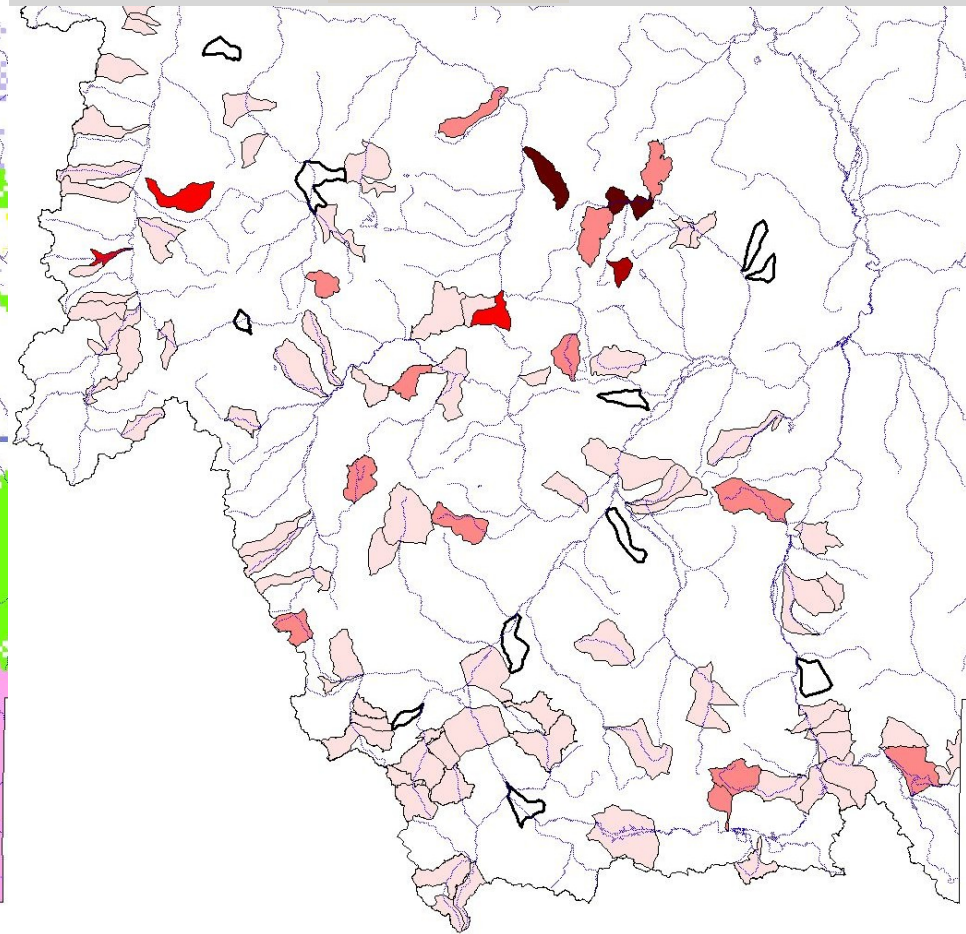


Percent of Lentic Sites with Reproduction

Inventory_hucs.shp



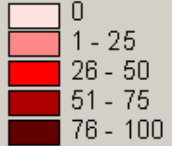
Black Outline =
Dry Watershed
or All Private



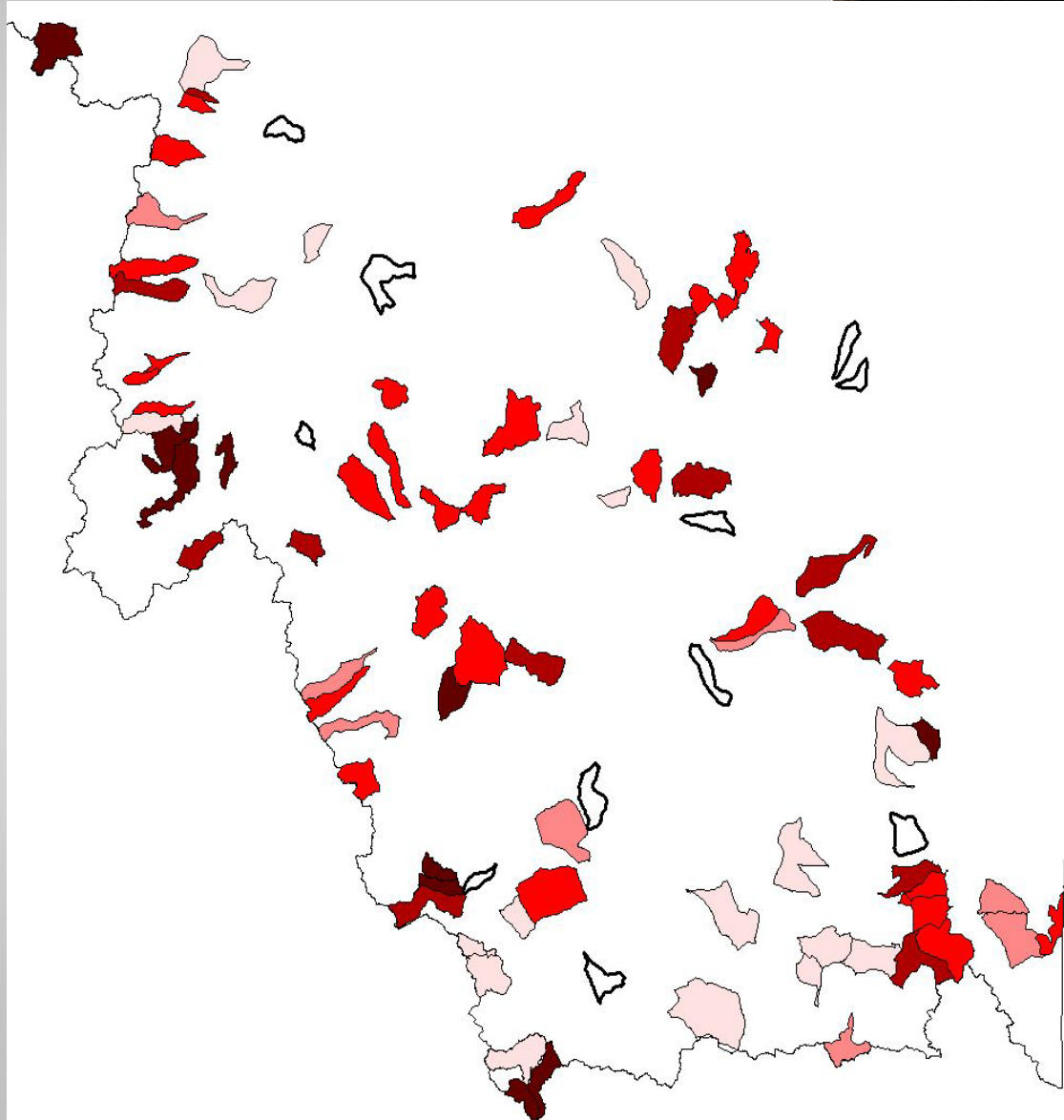
Percent of Permanent Lentic Sites with Fish



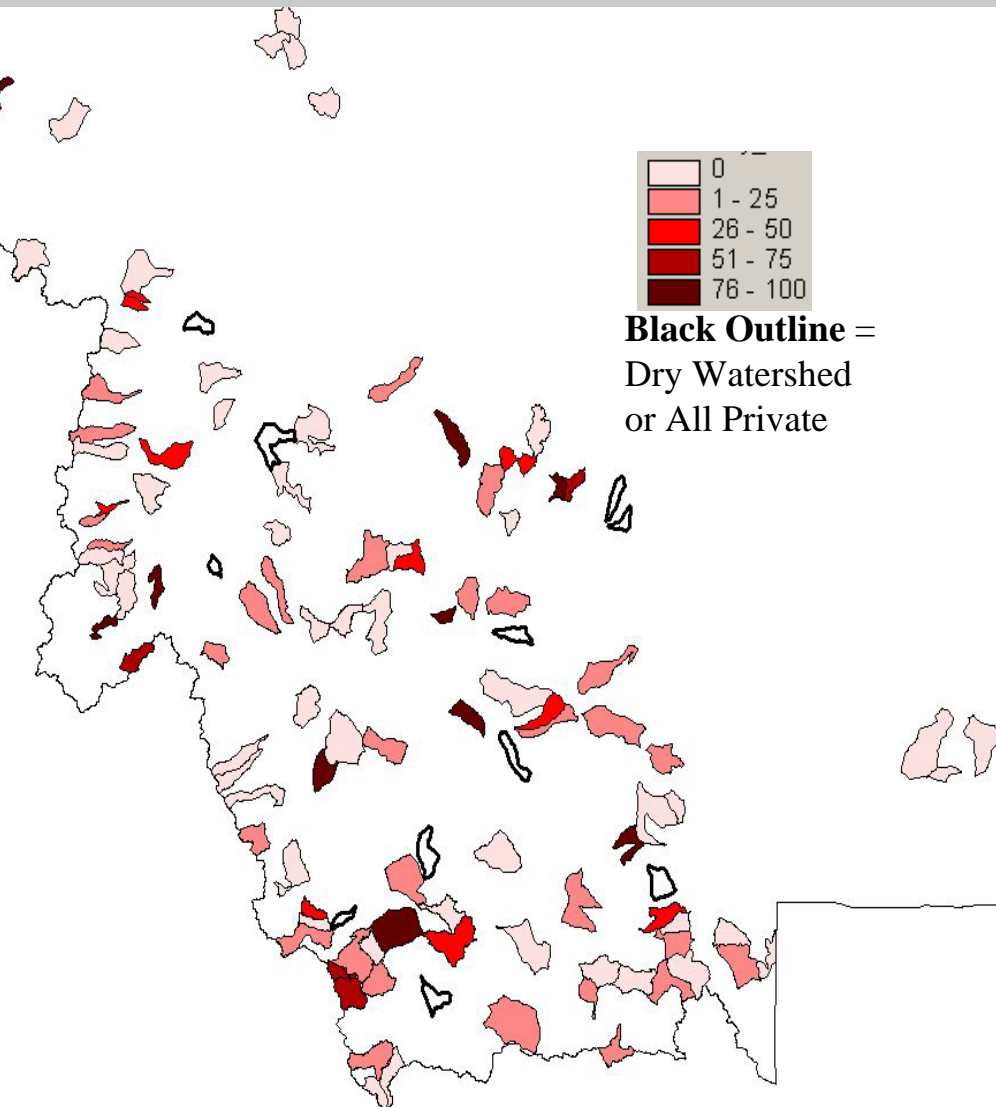
Inventory_hucs.shp



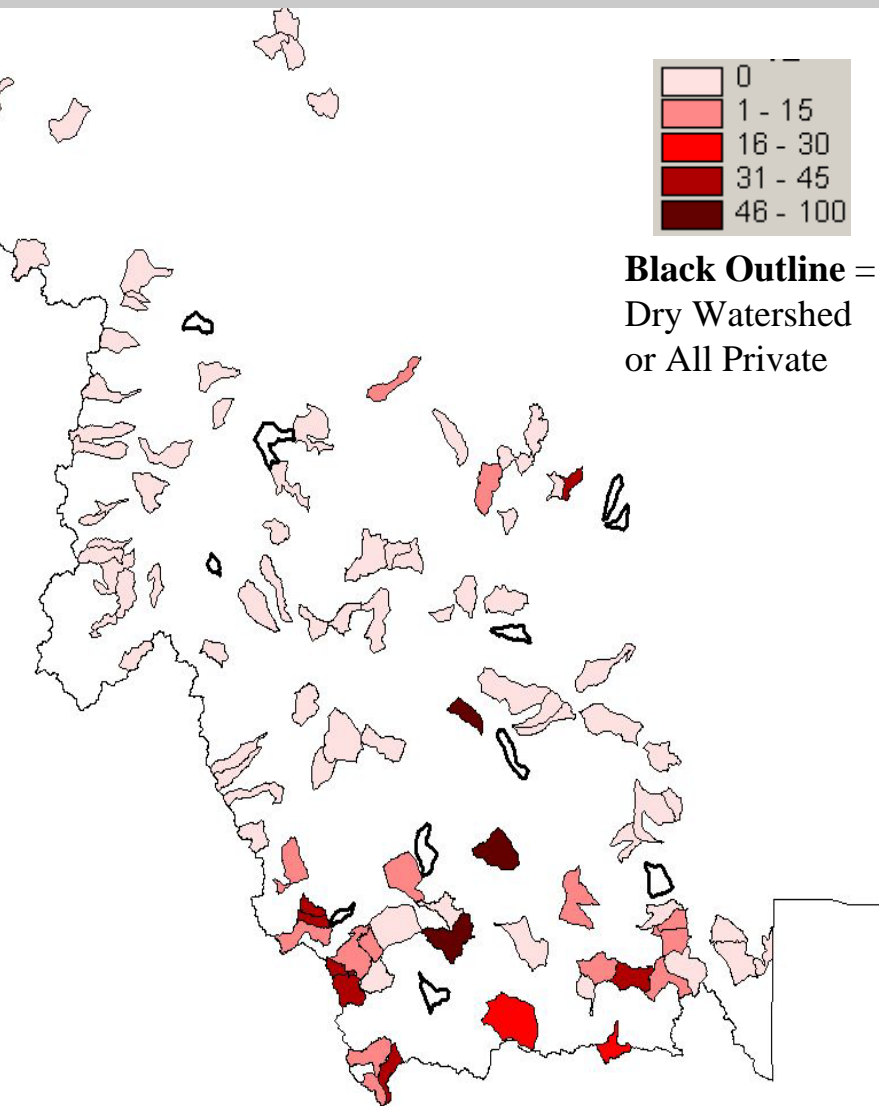
Black Outline =
Dry Watershed
or All Private



Percent of Lentic Sites Capable of Supporting Amphibian Reproduction with Water Dammed or Diverted



Percent of Lentic Sites Capable of Supporting Amphibian Reproduction Heavily Impacted by Cattle



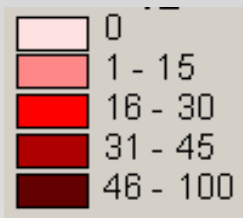
Grazing Impacts Example: Mud Lake Wetland



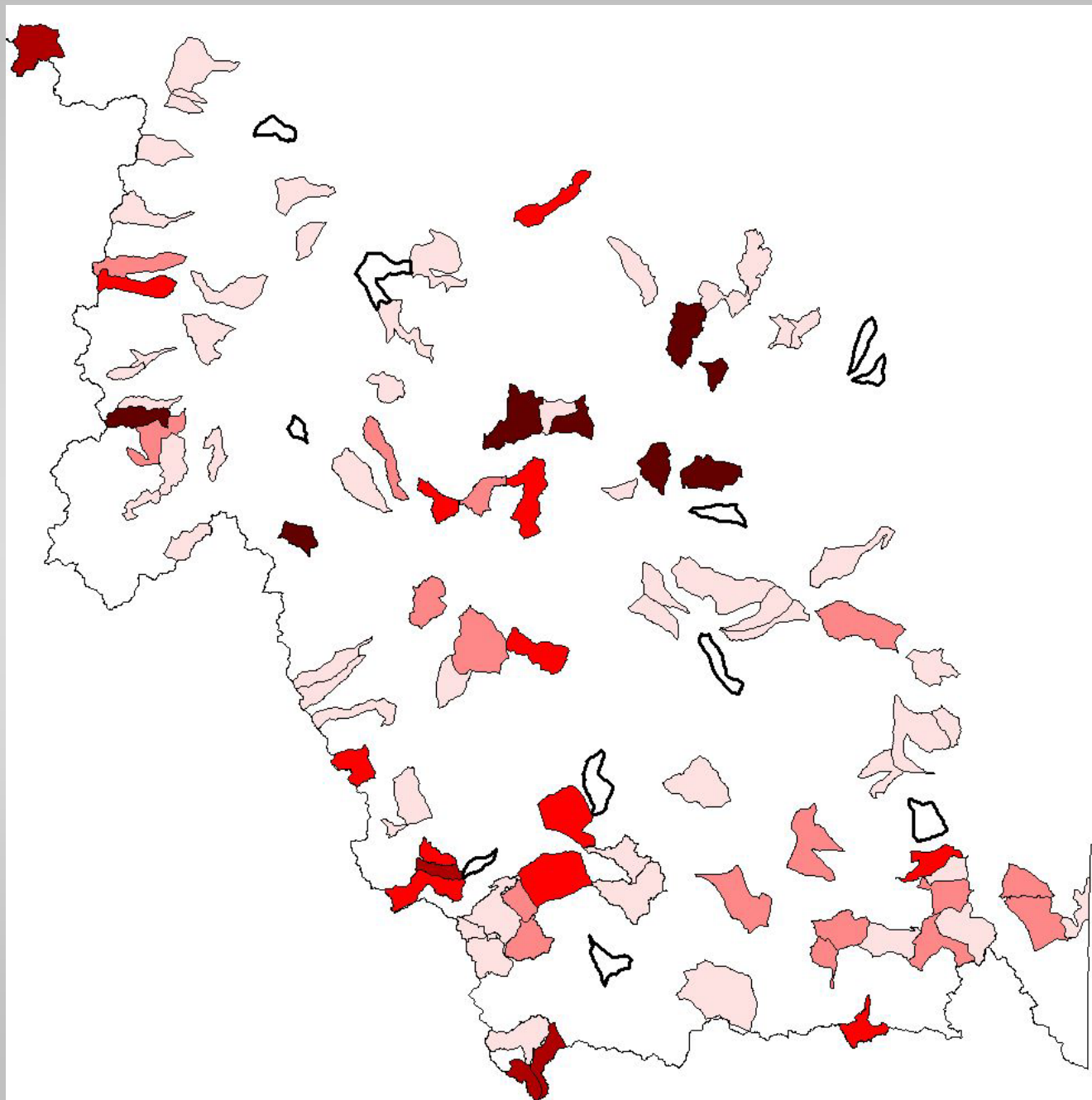
Grazing: Native Ungulates Versus Cattle



Percent of Lentic Sites Created By Beaver



Black Outline =
Dry Watershed
or All Private



Beaver: Clark Canyon southwest of Dillon



Beaver: Basin Creek south of Butte



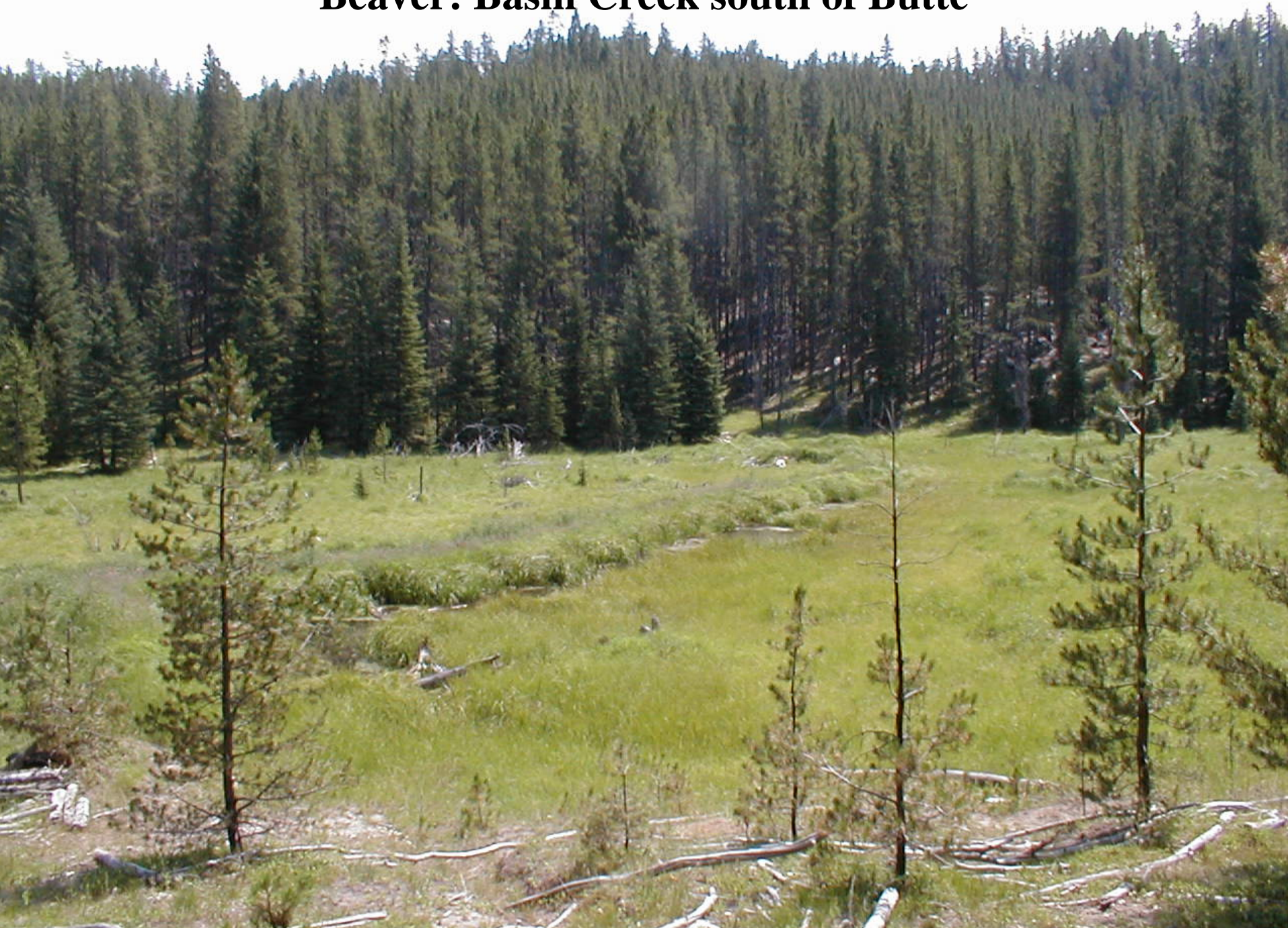
Beaver: Basin Creek south of Butte



Beaver: Basin Creek south of Butte



Beaver: Basin Creek south of Butte



Beaver: Basin Creek south of Butte



Beaver: French Creek northeast of Wisdom



Beaver: Maiden and Jeff Davis Creek (SW of Dillon)



Beaver: Maiden and Jeff Davis Creek (SW of Dillon)



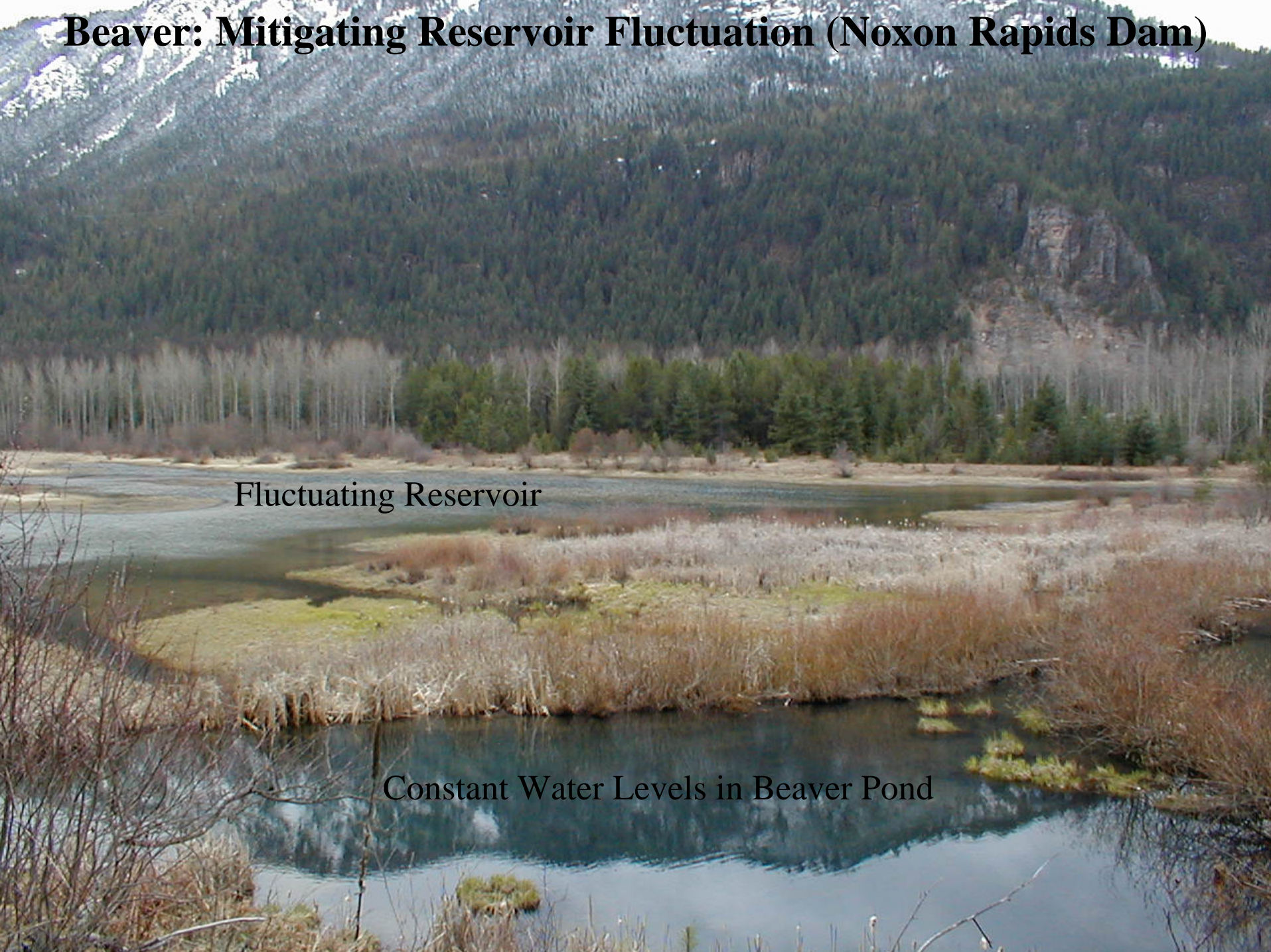
Beaver: Muddy Creek (SW of Dillon)



Beaver: Mitigating Reservoir Fluctuation (Noxon Rapids Dam)

Fluctuating Reservoir

Constant Water Levels in Beaver Pond



Distribution of Amphibian Fungal Pathogen and Need to Decontaminate Gear Between Wetlands

Positive = 

Negative = 

Sample sizes are listed above symbols

1970's Sampling Area

